



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 28 2003

THE ADMINISTRATOR

Dr. William Glaze
Chair
Science Advisory Board
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Dear Dr. Glaze:

Thank you for sending me a copy of the Science Advisory Board's review of the Office of Solid Waste's study, *Industrial Surface Impoundments in the United States*.

I was pleased to learn that the SAB was impressed by this study's contribution to our knowledge of the environmental impact of industrial surface impoundments. The Board's comments are crucial to our understanding of the potential risks associated with such impoundments. Your review will help us to identify areas where further research is needed and to design effective, appropriate programs for safely managing these wastes.

Enclosed you will find the Agency's response to the specific points raised in your review. If you have any questions, please contact Dr. Barnes Johnson of the Office of Solid Waste's Economics, Methods and Risk Analysis Division, at (703) 308-8881.

Again, my thanks to you and your SAB colleagues for your valuable analysis.

Sincerely yours,

/Signed/

Christine Todd Whitman

Enclosure

EPA's Response to the Science Advisory Board
on Review of the Office of Solid Waste's Study,
Industrial Surface Impoundments in the United States:
An EPA Science Advisory Board Report
(EPA-SAB-EEC-03-001)

This enclosure responds to points raised by the Environmental Protection Agency's Science Advisory Board (SAB), in its October 25, 2002 report entitled Review of the Office of Solid Waste's Study, *Industrial Surface Impoundments in the United States: An EPA Science Advisory Board Report*. EPA has found the commentary from the Science Advisory Board to be extremely informative and useful, and appreciates the overall positive and supportive commentary offered. Considerable time has passed since completion of this study in March 2001, and while resources are unlikely to be made available to analyze the surface impoundment data in light of the SAB comments, those comments will be useful as we implement our nonregulatory guidance program for nonhazardous industrial wastes. In the near future, EPA is planning to release an important guidance on approaches for the proper management of industrial wastes. We have already considered a number of the SAB comments that were delivered orally during the October 24-26, 2001 review meeting. Those comments and the findings of the surface impoundment study have already been reflected in the guidance. In addition, a significant portion of the guidance outlines a series of increasingly more sophisticated, tiered risk analysis steps. Many of the SAB suggestions will be highly relevant and useful for industrial waste managers who use the "Tier III" approach in the guidance. Under the Tier III approach, models and data are selected because of their site specific relevancy to the particular waste management setting that is under consideration.

EPA also sees great benefit from the SAB commentary not only regarding the Office of Solid Waste (OSW) study, but in future similar work in waste programs or other Agency programs. There are many such analyses in process, in OSW and in other parts of the Agency, and the SAB comments will be useful in these other analyses as well.

In many cases EPA agrees with the comments offered by the SAB. The item by item responses below paraphrase, summarize or quote the comments made in Section 3, "Response to the Charge," and indicates when EPA agrees and will consider the comment(s) in future related work. The EPA responses listed below focus on the SAB comments that suggested particular improvements that could be made to the study.

From pages 14, 15, 22 and 28 of SAB's report:

There were various comments that question the utility of the quantitative risk assessment for decision-making without quantitative uncertainty/variability estimates; suggestions to establish a formal transparent process for quantifying uncertainty/variability for all risk estimates; suggestions to use a risk indicator methodology rather than the quantitative risk assessment approach due to the potential cost of quantifying the major sources of uncertainty.

EPA's response: We agree that the risk assessment is most useful for decision making if uncertainty and variability can be quantified. We believe that we have performed a risk assessment that includes quantitative uncertainty/variability estimates, in that the various attributes of the study population can be estimated with statements about our confidence that they are accurate estimates, due to the probabilistic nature of the sampling scheme to draw the sample of facilities and impoundments. Since the Tier I results rest on this probabilistic scheme, and use extremely precautionary exposure assumptions, we believe that our Tier I results in fact are useful for decision making when combined with quantified confidence level statements. We acknowledge that the Tier II and Tier III results, which rely on risk estimates from models, include some model and parameter uncertainties that are not quantifiable at this point in time. As the risk assessment tools EPA uses are further developed and refined, in future related work, our expectation is that the more significant uncertainties will become easier to quantify.

From page 17 of SAB's report:

more effective application of transport and/or multimedia fate models to improve estimates of indirect and ecological chemical exposure

EPA's response: EPA agrees that, ideally, fate/transport models that could be used to estimate environmental media concentrations would have greatly simplified the tiering process and improved our ability to gauge ecological risks, but modifying the existing available models to meet the study's needs would have invited numerous other criticisms of various technical issues that would have been extremely difficult to resolve in the time allotted for the study. As part of the process of continually improving tools for assessing risks in the waste management arena, OSW has developed two risk analysis tools for nonhazardous waste managers that will allow them to explore how risks might change as the source area concentration changes. These two models are known as IWAIR (Industrial Waste AIR model) and IWEM (Industrial Waste Management Evaluation Model) and are to be published in the near future as part of EPA's Guide for Industrial Waste Management.

Development and implementation of ecological models that use home ranges for terrestrial vertebrates

EPA's response: EPA agrees that developing and implementing these models would be important to better characterize potential ecological risks.

Application of more accurate bioaccumulation models or factors for describing the wildlife foods that may be found in sludge/soil matrices

EPA's response: EPA believes that wildlife ingestion of contaminants is an emerging area of risk assessment science, and considerable effort would be needed to adapt existing knowledge of various species' dietary behaviors to EPA risk assessment work for broad national studies that include a range of different ecosystems.

Evaluation of the impact of using a higher threshold hazard quotient (e.g., 10 rather than

1) for evaluating the potential risks posed by chemicals managed in surface impoundments to the plant community

EPA's response: This is a good suggestion, since the contaminants in an impoundment present a fairly localized potential hazard to plants and would be unlikely to harm an entire plant community.

Development of defensible assumptions about piscivore diets (i.e., what fraction of these surface impoundments really has a fish community dwelling in them that would support a population of piscivores?)

EPA's response: Anecdotal information received during the study indicated that, in fact, some impoundments are capable of supporting a population of piscivores, but it is true that only a subset of the impoundments would have the right conditions to support fish populations at all, let alone piscivores. EPA did not pursue investigating the anecdotal information, but used it to support the precautionary assumption that the impoundment itself was used as habitat.

Evaluation of the impact of chemical exposure to ecological receptors through the air pathway

EPA's response: There were two reasons why EPA did not consider the air pathway for ecological receptors: first, using the CHEMDAT8 model to estimate air emissions at the impoundment, and ISCST3 for dispersion, for the first tier of the analysis would have been infeasible for the several hundred impoundments in the study sample, and second, air inhalation health effect benchmarks for various ecological species do not currently exist. This pathway is another emerging area where the risk assessment science would need to develop considerably.

From pages 17, 22, 24, 25 and 37 of SAB's report:

There were various comments such as: evaluate and document the impact of excluding from the analysis chemicals without readily available cancer potency values or reference doses; use surrogate health indices for identified chemicals that were not evaluated; quantitatively address uncertainty associated with lack of cancer potency values

EPA's response: To evaluate the impact of excluding chemicals without readily available health benchmarks, EPA would need to make certain assumptions about potential potency values or reference doses and run the analysis using those assumed values. The value of such an exercise will depend greatly on the underlying assumptions used to derive potency values where none are available. EPA did use certain surrogate health indices for some of the chemical constituents for which no health benchmarks were available, according to the protocol described in Appendix C, Attachment C-2 of the report. EPA specifically did not extrapolate toxicity values based on oral exposure routes into air inhalation benchmarks, or otherwise develop values for exposure routes for which no data were available, since doing so could invite criticism from peer reviewers and stakeholders for creating misleading risk estimates that were not based on data from actual exposure routes.

From page 18 of SAB's report:

consider characterizing the risk as a distribution that includes children and high-risk groups

EPA's response: EPA agrees with the comment. Although we did consider children in the human health risk analysis, by varying the exposure factors, we did not present the results to distinguish children's exposure on a continuum that includes adults, children and high-risk groups. We will consider appropriate changes to help improve our analyses in the future.

From page 19 of SAB's report:

modify the chemical release assessment (Tier II) methodology to include a greater number of risk indicators

EPA's response: EPA agrees with the comment. In future, related work, we will consider adopting this approach.

From page 20 of SAB's report:

evaluate impact on risk results of excluding biotransformation, chemical transformation, colloidal transport and fracture flow in the Tier II and III models

eliminate the use of binning to portray the human health risks associated with indirect chemical exposure

EPA's response: EPA agrees with these comments. The state of risk assessment science would need to develop in order to understand biotransformation and chemical transformation for the many chemical constituents in the study's scope, but in future related work our expectation is that, for some of those chemical constituents that transform into more toxic compounds via biological and chemical phenomena, we will have better data on transformation processes and resulting compounds. Similarly, colloidal transport and fractured flow are two areas of groundwater transport research that are under development, and our expectation is that future related work in waste programs and perhaps throughout the government sector, will take advantage of these developments. Regarding the binning approach, EPA agrees with the comment.

From page 21 of SAB's report:

evaluate model output sensitivity to input parameter changes

explicitly describe the selection process for groundwater probabilistic parameters, how probability distribution shapes were assigned, how functional dependencies of probabilistic input parameters were modeled, how probability distributions were truncated, and groundwater flow direction judgments and how uncertainty from this is captured in the results

EPA's response: EPA agrees with these comments and will consider appropriate changes to help improve such analyses in the future.

From page 22 of SAB's report:

Use of different approaches (deterministic versus probabilistic) to evaluate the human health risks associated with different exposure pathways is not technically justifiable

EPA's response: Current EPA policy on use of probabilistic risk assessment approaches¹ is not intended "to recommend that probabilistic analysis be conducted for all risk assessments supporting risk management decisions. Such analysis should be part of a tiered approach to risk assessment that progresses from simpler (i.e., deterministic) to more complex (e.g., probabilistic) analyses as the risk management situation requires."

EPA agrees generally with the comment to the extent that using different approaches to estimate risks associated with different exposure pathways can make it difficult for decision makers to compare those risk estimates. However, when in the initial, screening stages of a risk assessment, it may not be appropriate or necessary to conduct a probabilistic risk assessment, and conducting a deterministic risk screen is a perfectly adequate technique for meeting the decision maker's needs.

In this study, EPA developed an overall study sample (for the two main subpopulations) that was a probability sample, in order to portray to the decision makers what are the probabilities of impoundments existing with particular combinations of attributes. For some pathways EPA was able to perform a probabilistic risk assessment (notably the direct human health groundwater, and groundwater to surface water pathways) for selected sites, or rely on a previously conducted probabilistic risk assessment (the air inhalation pathway). However, we acknowledge that we did not analyze consistently all pathways associated with a given tier of the analysis.

From page 23 of SAB's report:

wildlife food uptake factors were not always conservative estimates

address the issue of whether ecological toxicity due to the simultaneous exposure of multiple chemicals may lead to risks that are additive, less than additive or, in some cases, synergistic

additional scientific justification to support assumption that a constant chemical concentration would tend to overpredict the potential risks of chemical exposure to wildlife

improve the qualitative ecological risk results uncertainty descriptions

¹"Policy for Use of Probabilistic Analysis in Risk Assessment at the U.S. Environmental Protection Agency (May 15, 1997)"; see <http://www.epa.gov/ncea/mcpolicy.htm>

EPA's response: EPA agrees with these comments, and will consider appropriate changes to help improve such analyses in the future.

From page 24 of SAB's report:

greater transparency in data quality/types for release assessment and risk modeling

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

From page 27 of SAB's report:

phenomena such as metal solubility changes due to changes in wastewater pH, and the impact of fine particulates on mobilizing contaminants through adsorption or ion exchange mechanisms are not addressed in the modeling effort, but the risks associated with these phenomena should be accounted for

recommends that watershed modeling approaches that incorporate high-impact storms of appropriate return periods be integrated into the methodology to address risks associated with stormwater influx into impoundments

an assessment of the design and geographic distribution of impoundments vis-a-vis earthquake zones is necessary to establish the risk of catastrophic failures within the timeframes of concern

EPA's response: EPA agrees with these comments and will consider appropriate changes to help improve such analyses in the future.

From pages 28 and 29 of SAB's report:

assess how risk assessment framework includes impact of abnormal operating conditions on source term

source term characterization did not include all potential release mechanisms

EPA's response: EPA agrees with these comments, in that we should have performed (and documented) a more formal assessment than we did. During the study, we considered, but did not document, the possible impact on the source term of a dike or berm failure scenario, a seismic event scenario, and the scenario in which a major storm event causes scouring of the impoundment contents. For the dike or berm failure scenario, the elevation of the water in the impoundment relative to the surrounding land is relevant to whether a release would even occur. Although the survey requested data on impoundment water elevation, the quality of the data received varied widely and these data quality problems precluded a more rigorous analysis of this scenario. For either the seismic event or major storm event scenario, the elevation of water in the

impoundment relative to the surrounding land is less relevant, and the data quality issues did not preclude us from considering these two scenarios further. Rather, we considered that the impact of these two scenarios on the source term would be to spread the source term out over a larger geographic area than the normal confines of the impoundment, effectively diluting the impact of the contaminants to some degree. For either the storm or seismic event scenario, our expectation was that this dispersal of the source term over a larger area would be time limited, and relative to the service life of the impoundment the time duration of these dispersals would be relatively small. Thus, the investment in the modeling changes that would be needed to represent these scenarios did not seem warranted.

From page 29 of SAB's report:

assess need to account for liners/liner failures when evaluating over long time horizons

EPA's response: EPA agrees with this comment. The relatively short timeframe in which liners have been used routinely in waste management units (on the order of a few decades at most) has precluded the necessary long-term research on liner failure rates and frequencies, but as we gain experience with liner systems we expect that more data on liner service lives and failure situations will be developed and will be used in future analyses.

explicitly indicate that EPACMTP does not consider transient events

EPA's response: EPA acknowledges this limitation of the modeling framework that we used.

explicitly indicate how presence/absence/failure of liners is considered over the 10,000 year time horizon

EPA's response: EPA acknowledges that, ideally, modeling tools used in EPA risk assessment work should have such capabilities. We will consider making changes to help improve such analyses in the future.

From page 29, footnote 3:

Comments regarding changes to Figure 3.1 in EPA's report, including changing the title to "Conceptual model of the potential relationships between chemical stressors from active surface impoundments and human and ecological receptors" and then changing the figure to show all potential relationships rather than just those considered in the analysis

EPA's response: The intention of the figure was to illustrate the potential pathways that were considered in the analysis, not to illustrate all potential exposure pathways. Thus, although the suggested changes would illustrate all potential pathways for the ecological portion of the figure, the same would need to be done for the human health portion and the report would still need a figure such as Figure 3.1 in order to indicate which of all potential pathways were considered in the analysis. We acknowledge that, for readers interested in a more complete

problem description, the report should contain a conceptual model that illustrates all potential pathways and then the subset of all possible pathways that were considered in the analysis.

From page 32 of SAB's report:

EPA should collect additional, regional information, e.g. from public sources, to conduct additional analyses.

EPA's response: As the SAB acknowledged, EPA collected additional site-specific information (generally, state surface water discharge permits) from public agencies for each of the approximately 200 facilities evaluated in the risk analysis. Some of the information collected, as well as the U.S. Geological Survey information on seismic zones, may indeed be useful for conducting additional analyses. During the study period, the Federal Emergency Management Agency was beginning to modernize (digitize) its flood hazard maps, but digitized versions were not available in enough locations to allow us to incorporate them into our analysis. (There were several hundred impoundments in the study sample.)

From page 33 of SAB's report:

Apply empirical safety factors (proportional to the most probable intensity or magnitude of events or phenomena) to source term concentrations in scenarios and zones of abnormal operating conditions

EPA's response: EPA acknowledges that this approach could be a helpful way to integrate the periodic, infrequent nature of abnormal events into the risk assessment framework. Until the assessment is performed, however, EPA does not agree that the safety factor will necessarily increase the size of the source term concentrations used in the analysis; due to the geographic spreading of contamination in either a seismic or storm event scenario (described above), it is possible that the actual source term concentrations will decrease (if the same mass is present but is distributed over a wider area). Thus, EPA will consider making appropriate changes to help improve such analyses in the future.

From page 34 of SAB's report:

After a certain specified service timeframe, EPA should use a conservative assumption that the impoundment is no longer containing the contaminants of concern - a "Zero Containment Assumption"

Establish a quantitative relationship between degradation of major impoundment components and the magnitude of a transient event over time, and model the growth in the source term in response to increases in contaminant release volumes - "Impoundment Degradation and Contaminant Release Modeling"

EPA's response: EPA agrees with these comments and will make appropriate changes to help improve similar analyses in the future.

From page 37 of SAB's report:

consider indoor volatile organic compound pathway of home shower water

EPA's response: In recent years, this pathway has become relatively straightforward to include in risk assessments, and OSW is including it routinely in analyses. The Guide for Industrial Waste Management (under development) includes this scenario in the risk calculations that facility managers can use to determine appropriate waste management practices for their facilities.

consider pathway that includes impoundment water for crop irrigation

EPA's response: Technically this is a relatively easy pathway to include in the analysis. However, EPA does not know how plausible this pathway is given that we did not ask about this use pattern on the survey.

consider the pathway that includes industrial sludge land application

EPA's response: This waste management setting was not included within the study's scope.

justification for assumption that ecological receptors were not susceptible to air exposures would be helpful

EPA's response: Similar to the comment from page 17 of SAB's report, "*Development and implementation of ecological models that utilize home ranges for terrestrial vertebrates,*" such models would be helpful in understanding how much exposure to airborne contaminants from impoundments terrestrial vertebrates receive, and would illuminate whether or not our assumption was justified. EPA acknowledges that a more rigorous description of the current state of knowledge of plant and invertebrate receptors' susceptibility to harm from airborne contaminants should have been included.

binning approach (potential, less, least) is potentially misleading.

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

In a more refined ecological risk assessment, include the ecological receptor exposure implications of various transient event scenarios (dike failure, overtopping, flooding, liner failure)

EPA's response: EPA agrees with the comment. It is possible that related work by other agencies (e.g., Mine Safety and Health Administration, in investigating coal waste impoundment failures) will yield important and useful information for EPA to consider in future, related work.

From page 38 of SAB's report:

describe how the bioaccumulation potential of a chemical compound was determined (USEPA, 2001, p. C135) and how the potential to volatilize was determined

define how the cutoff points for volatilization (< 250 m, 250-500 m, >500 m) and particulate entrainment (>300m, 150-300 m, <150 m) were based (USEPA, 2001, p. C142)

"direct ingestion or uptake of the surface impoundment influent" (pp. 3-41 and 3-62 of the report (USEPA, 2001)) is misleading

screening level risk assessment results presentation should be modified

EPA's response: EPA agrees with these comments and will consider appropriate changes to help improve such analyses in the future.

From page 39 of SAB's report:

need to clarify ecological risk conclusions, explanations of facility, impoundment and constituent risk

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

From page 42 of SAB's report:

certain tables and related text use inconsistent phrases (e.g., Tables C.1-16 and C.1-17, USEPA, 2001)

ecological risk results based on survey data should be distinguished from those based on surrogate and detection limit data, and (for sludges) those based on survey data versus those based on calculated sludge data

EPA's response: EPA agrees with these comments, and will consider appropriate changes to help improve such analyses in the future.

From pages 48 and 49 of SAB's report:

clarify what the default detection limits are for comparison with assumption about actual concentrations; use field sampling and reported survey data for comparisons

although the sludge default detection limits are probably sufficiently conservative, EPA should compare them to the Office of Water's detection limits

EPA's response: EPA agrees with the comment and will consider appropriate changes to

help improve such analyses in the future.

From page 49 of SAB's report:

determine the sensitivity of the model outputs for the direct pathways due solely to the detection limit substitution protocol (run model with concentrations of zero and half the detection level concentrations; also conduct such an analysis for impact on ecological and indirect pathway risks)

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

from page 51 of SAB's report:

EPA did not implement step six of the Data Quality Objectives process in a quantitative manner

describe sensitivity of the conclusions from not performing field sampling at nine of 17 Standard Industrial Classification groups

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

From page 52 of SAB's report:

further explore the bias and range of values when comparing sampling data to survey data

use the sampling data to evaluate the surrogate data protocol. If already done, present the outcome more clearly

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

From page 53 of SAB's report:

clarify whether additional constituents quantified in field sampling provided supplemental data for use in uncertainty analysis (page E-17 (bottom) of Appendix E of the report (USEPA, 2001))

identify and evaluate local, State and Federal requirements for the 12 field sampling facilities to determine if the facilities were responsible for detecting the unreported constituents at the concentration levels reported

EPA's response: EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.

Structure survey questions to obtain more complete and sufficient information on concentrations

EPA's response: The survey questions were structured very carefully to maximize respondent participation in the survey. If survey respondents were required to analyze their wastewaters, leachate and sludges specifically for this survey, to specified concentration levels, the "burden," or cost and labor effort, for the respondents would have been extremely high and may have jeopardized the survey's approval for distribution. The survey questions were structured so that respondents could provide as much information as they could manage, given their own time and resource constraints, and from that information EPA attempted to characterize

their impoundments' contents as completely as possible. In many cases EPA had to extract concentration information that was buried in laboratory sampling reports that were submitted with the surveys, because asking for copies of laboratory reports was less onerous for survey respondents than asking them to extract the information themselves to complete the survey form. EPA took several steps to encourage survey respondents to provide as much information as they could, including participating in industry-sponsored question and answer sessions, so that communications between EPA and the survey respondents were as clear as possible.

From page 58 of SAB's report:

conduct sensitivity analyses to identify sensitive parameters

EPA's response: When developing the survey instrument, EPA conducted a preliminary sensitivity analysis for several different constituents of concern, and found that the most sensitive model parameters varied somewhat depending on the particular constituent of interest. In addition the modeling framework and data sets used in the final analysis differed from those evaluated in the sensitivity analysis, and as a result we did not document this preliminary sensitivity analysis in our report. EPA agrees with the comment and will consider appropriate changes to help improve such analyses in the future.